

LETTER TO DR. P.B. ON
THE MOTIVATIONS OF SCIENTISTS

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In 2001 I received a letter dated July 24 of that year from a Dr. P.B. The letter was accompanied by some sheets labeled "Response to ISAIF," in which Dr. B. expressed a number of criticisms of that text. Among other things, Dr. B. disagreed with my statement (ISAIF, ¶¶ 88–89) that scientists were not motivated primarily by a desire to benefit humanity. Due to the pressure of other work, it was not until May 2009 that I got around to writing a reply¹ to Dr. B.'s contention. What follows is a heavily rewritten version of that reply.

I. Dr. B. found my discussion of the motives of scientists to be "particularly weak." He wrote: "A long discussion of why Mr. Teller is a Bad Man. Which is fine. But when we think of physicists, most of us think of Einstein before Teller, and Einstein is an exemplar of one who completely contradicts [ISAIF's statement that scientists are not motivated primarily by a desire to benefit humanity]—but by no means the only one." Dr. B. further remarked that I "essentially denie[d] moral agency to scientists," and he added, *inter alia*:

In talking with people who I think have worked in what are to me genuinely negative fields of research—weapons design at Lawrence Livermore, for instance—I find that those who are directing and actively engaged in the work are there because they think they are doing the right thing for the country, even with all the risks their work entails, and that by doing the right thing for the country, they do the right thing for the world. These people are actively aware of and engaging their moral agency...

Dr. B. conceded, however, that there were scientists who acted "more in support than in directing the work" of weapons design, and who saw their jobs as "ethically neutral."

First let's get this straight: It should have been obvious that in paragraphs 87–89 of ISAIF I was discussing the *usual* or *typical* motivations of scientists; I was not concerned with the occasional exception. Thus, if it could be proven that 1% or even 5% of scientists were indeed motivated by a desire to benefit humanity, that would not seriously affect my argument. It

should also have been obvious that in asking about the motives of scientists I was referring to their motives *for doing scientific work*, not to their motives in other matters. I've never claimed that the majority of scientists were unconcerned with moral issues. It is one thing to say that a scientist is concerned with moral issues and quite another to say that moral issues provide his principal motive for doing research. (One can, however, find plenty of examples of amorality among scientists, some of which we will see further on.)

Thus, the argument that scientists are not motivated primarily by a desire to benefit humanity does not deny moral agency to scientists—outside of the laboratory. Dr. B. mentioned Einstein. Einstein worked for world peace—or at least preached in favor of it—and his motive for doing so no doubt was highly moral. But that says nothing about his motive for doing research in physics.

Dr. B.'s contention presumably was that scientists acted as moral agents *in doing their scientific work*. Back in 2002 I put Dr. B.'s theory to the two prison psychologists here, able men in my opinion, who described themselves as "hard-nosed rationalists" and eschewed dubious theories such as Freudianism. I quote from my notes dated April 9, 2002:

Because I'm planning a response to a letter I received some time ago from [Dr. P.B.], when Drs. Watterson & Morrison came by today, I asked them... whether they'd gone into the field of psychology in order to serve their own personal needs or... to do good for the human race. They both said they'd become psychologists in order to satisfy their own personal needs. Then I asked them whether they thought that most psychologists became psychologists in order to... do good for the human race, or in order to serve their own personal needs. Both Dr. Watterson & Dr. Morrison said that most psychologists bec[a]me psychologists in order to satisfy their personal needs ('especially ego needs,' said Watterson), and not to do good for the human race. Morrison added that a lot of psychologists will *say* they became psychologists in order to help people, but that's not their real motive. I told Watterson & Morrison of [Dr. B.'s] opinion that scientists were 'moral agents.' Watterson & Morrison appeared to find this amusing. Morrison suggested, tongue in cheek, that I should write to [Dr. B.]... [and] give him a one-line response that reads 'Get a life!'

II. We've seen that Dr. B., in order to support his argument, claimed to "find" that people who were "directing and actively engaged" in the design of military weapons thought they were doing the right thing for

the world and were “actively... engaging their moral agency.” How did he “find” this? Apparently from the mere fact that they told him so. But if these people were utterly cynical about their work, would they come right out and say so? It’s hardly likely. If an individual is unscrupulous enough to do harmful work to satisfy his personal needs, he will certainly be unscrupulous enough to lie about his motives.

There are people whose opinions of scientists involved in military research are very different from Dr. B.’s. In his self-accusing postwar memoirs, Hitler’s Minister of Armaments wrote:

I exploited the phenomenon of the technician’s often blind devotion to his task. Because of what seems to be the moral neutrality of technology, these people were without any scruples about their activities. The more technical the world imposed on us by the war, the more dangerous was this indifference of the technician to the direct consequences of his anonymous activities.²

Would any of these technicians have admitted openly to outsiders that they were indifferent to the consequences of their work? Probably not. A case in point is that of Wernher von Braun, who was Hitler’s chief rocket-scientist and directed the development of the V-2 rocket that killed some 20,000 civilians in Allied countries during World War II.³ Von Braun claimed after the war that his motives had been “patriotic.”⁴ But while he was working for Hitler von Braun must have known that the Jews were being exterminated, since this was “a kind of open secret in Germany from the end of 1942 at the very latest.”⁵ What kind of patriotism would lead a man to build weapons for a regime that exterminates entire ethnic groups from sheer spite? It is sufficiently clear that “patriotism” was merely an excuse for von Braun, and that all he really wanted was to build rockets for their own sake. “As World War II neared its end in early 1945, Braun and many of his associates chose to surrender to the United States, where they believed they would likely receive support for their rocket research... ”⁶

The point here is not that building weapons for Hitler is morally equivalent to building weapons for a democratic regime like that of the United States. The point is that scientists commonly attribute to themselves noble-sounding motives such as “patriotism” that don’t necessarily have anything to do with their real motives. And, no, this practice is not limited to those who build weapons for dictatorial regimes.

In the United States, the development of the first atomic bomb was directed by a physicist named J. Robert Oppenheimer. In a speech delivered on November 2, 1945, to the scientists who had participated in the bomb project at Los Alamos, New Mexico,⁷ Oppenheimer remarked: "One always has to worry that what people say of their motives is not adequate." Oppenheimer then ran through the usual excuses that scientists gave for working on the atomic bomb: The Nazis might have gotten the bomb first; there was no place in the world where the development of atomic weapons would have had a smaller chance of leading to disaster than in the United States; the real importance of the scientists' work lay not in weapons but in the benefits that atomic energy would bring to mankind; etc., etc., etc. Oppenheimer noted that all these rationalizations had more or less validity, but insisted that the real reason why the scientists had developed the bomb was that, for them, their work was a personal need, an "organic necessity." Scientists, in Oppenheimer's view, lived by a philosophy according to which the acquisition and diffusion of knowledge was an end in itself, independently of whether it brought any practical benefit to the human race.⁸

The implications of Oppenheimer's speech are evident even though Oppenheimer did not state them clearly: Scientists work not for the benefit of humanity, but in order to satisfy their own needs. While Oppenheimer probably believed that science did on balance benefit humanity, he recognized that the justification of science in terms of benefit to humanity was essentially a rationalization that did not represent scientists' real motives.

It is significant that the printed version of this speech found among Oppenheimer's papers was marked: "This material is not for public release. A revised version will probably appear soon in one of the scientific journals."⁹ In fact, however, the speech seems never to have been published, in "revised" form or otherwise, prior to its inclusion in Smith & Weiner's book on Oppenheimer.¹⁰

III. Apparently Oppenheimer was not very comfortable with what he himself said about scientists' motives. But some scientists have stated their motives more forthrightly than Oppenheimer did and with no sign of discomfort.¹¹

Werner von Siemens was a 19th-century electrical engineer who invented the self-exciting generator and made other important advances in the applications of electricity.¹² In a letter dated December 25, 1887,

Siemens described his motives:

Certainly I have striven for profit and wealth, but not mainly in order to enjoy them; rather to gain the means for the *execution of other projects and undertakings*, and by my success to win recognition of the correctness of my procedure and the usefulness of my work. Therefore from my youth upward I have yearned to establish a world-wide firm such as that of Fugger, which would assure not only to myself but also to my successors power and esteem in the world, and the means also of raising my sisters and other near relatives to higher standards of life. ...

I regard our business as only secondarily a source of wealth; for me it is rather a kingdom that I have founded and that I hope to leave intact to my successors for further *creative work*.¹³ [Emphasis added.]

Not a word about the benefit of humanity. But notice the importance that Siemens puts on the execution of “projects,” “undertakings,” and “creative work” *for their own sake*. Thus, surrogate activities. See ISAIF, ¶¶ 38–41, 84, 87–89.

Yet, surely, scientists who work in fields having an obviously humanitarian purpose, such as the treatment of disease, are motivated by a desire to benefit the human race—aren’t they? In some cases perhaps. But in general I think not. The bacteriologist Hans Zinsser wrote:

[N]ever having had any close association with workers in the field of infectious diseases, he shared this misconception of the noble motives which impelled these queer people. And not quite understanding how anyone could be impelled by noble motives, he asked us: ‘How do bacteriologists get that way?’ ... As a matter of fact, men go into this branch of work from a number of motives, the last of which is a self-conscious desire to do good. The point is that it remains one of the few sporting propositions left for individuals who feel the need of a certain amount of excitement. Infectious disease is one of the few genuine adventures left in the world. ... About the only genuine sporting proposition that remains unimpaired by the relentless domestication of a once free-living human species is the war against these ferocious little fellow creatures...¹⁴

Dr. B. mentioned Einstein as one whose work was motivated by a desire to benefit humanity, but it can be demonstrated that Dr. B. was wrong.

In 1917 Einstein wrote: "Our entire much-praised technological progress, and civilization generally, could be compared to an axe in the hand of a pathological criminal."¹⁵ It is therefore difficult to conceive of any altruistic motive for Einstein's scientific work. Einstein must have realized that any advance in physics would be likely to have practical applications and therefore to contribute to the technological progress that he had compared to an axe in the hand of a criminal, yet he continued his work in theoretical physics until very late in life¹⁶—even after he had seen the development of nuclear weapons, to which his own research had contributed. So why did he continue his work? It may have been a kind of compulsion. Toward the end of his life he wrote: "I cannot tear myself away from my work. It has me inexorably in its clutches."¹⁷

Whether it was a compulsion or not, Einstein's scientific work had nothing to do with any desire to benefit the human race. In an autobiography¹⁸ that he wrote at the age of 67, Einstein described his reasons for devoting himself to science. As a small child he was already oppressed by a sense of the "vanity" or "emptiness" (*Nichtigkeit*) of hoping and striving. This suggests a depressive and defeatist mentality. Einstein moreover seems to have been too delicate a child to face the workaday world, for he saw at an early age what he called the "cruelty" of the busy effort (*Treiben*) that was necessary in order to make a living. At first he tried to escape from these painful feelings by becoming deeply religious, but at the age of twelve he lost his faith as a result of reading scientific books that disproved the tales of the Bible. He then turned for solace to science itself, which provided him with a "paradise" that replaced the religious paradise he had lost.¹⁹

It thus appears that, for Einstein, scientific work was not only a surrogate activity, but also an escape from a world that he found too harsh. In any case, it is certain that Einstein turned to science solely in order to satisfy his personal needs; nowhere in his autobiography did he suggest any ways in which his research might improve the lot of the human race.

IV. For every scientist I can name whose stated motive has been to satisfy his personal needs, one could perhaps name many who have claimed an altruistic motive. Altruistic motives certainly are not impossible. For example, I would guess that many people who do field studies in botany and zoology are motivated at least in part by a genuine love for wild plants and animals. Nevertheless, claims of altruistic motives—or, to

put it more accurately, of motives that are accounted admirable under the norms of the present society—must in general be given very little weight. While a scientist who admits to a selfish motive may lower himself in the eyes of the people around him, one who claims a “noble” motive fulfills the expectations of other people and assures himself of their approval if not their admiration. It is a truism that most people, most of the time, will say what they think will win the approval of their peers. No doubt this sometimes involves conscious dishonesty, as was certainly the case with von Braun when he claimed that his motives were “patriotic.” More often, I think, scientists believe their own rationalizations. Science has its own self-congratulatory ideology, and one of the functions of ideology is to justify the believer in his own eyes. As the sociologist Monnerot explains, ideology

offers a *different version* of the relation between the motive and what it motivates. The materials which compose an ideology, and which it organizes, can face the full light of day, so to speak. They are not only allowable but honorable, and they constantly seek to affirm their relationship with the recognized social values. ... The aspirations of the [believer] are translated into ethical and social terms by ideology...²⁰

But the ideology that represents science as a humanitarian enterprise is belied by the actual behavior of scientists. The image of scientists as dedicated humanitarians originated at a time when to many people it seemed plausible to assume that scientific and technological progress were unequivocally beneficial, and when scientific work usually was not very remunerative. An occasional applied scientist might become rich—we’ve already noticed the case of Werner von Siemens, and Alfred Nobel, the inventor of dynamite, provides another example—but typically the scientist toiled in his laboratory year after year on a professor’s meager salary for sheer love of the work. Hence, he gave the impression of being an unselfish idealist. A few scientists even refused opportunities to profit financially from their research. Thus Roentgen, the discoverer of X-ray photography, donated the money from his Nobel prize to a university, and both he and the Curies (who discovered radium) declined to patent the processes they had invented.²¹ So there is nothing surprising about the fact that scientists acquired a reputation as unselfish benefactors of mankind—which in some cases no doubt they believed themselves to be.

But all that changed during the course of World War II, when science demonstrated its crucial importance as an instrument of power. Norbert Wiener, a distinguished mathematician and pioneer computer scientist, wrote in 1956:

In most previous times, the personnel of science had been seeded by the austerity of the work and the scantiness of the pickings. ... Thus, an ambitious man with slightly anti-social tendencies, or, to put it more politely, indifferent to spending other people's money, would formerly have avoided a scientific career as if it were the plague itself. From the time of the war on, these adventurers, who would have started out as stock promoters or lights of the insurance business, have been invading science.²²

The scientific community in the form in which it existed before the war could have been considered as a social movement, and from that point of view what Wiener was describing was simply the corruption that overtakes any social movement when it begins to offer its adherents such advantages as money, status, or a career.²³ Needless to say, the corrupting process has continued since Wiener's time, and by now the corruption of science should be obvious to anyone.²⁴

Outright scientific fraud "has been revealed, in confidential surveys, to be much more widespread than scientists like to acknowledge."²⁵ The case of the Korean Cloner, for example, was well publicized in 2006: "Cloning pioneer Hwang Woo Suk admitted in court... that he falsified much of his data."²⁶ A major scandal involving researchers at Duke University was reported in 2011, and, significantly, journals in which the researchers' flawed papers had appeared were reluctant thereafter to publish letters critical of them.²⁷

Outright fraud presumably is committed only by a small minority of scientists, but many more participate in practices that come perilously close to fraud. In order to plant a slanted article in a medical journal,

a medical-communications agency and its pharmaceutical-company sponsors will agree on a title for an article and a potential author, usually an academic physician with a reputation as a 'thought leader.' The agency will ask the thought leader to 'author' the article, sometimes in exchange for a fee. [A] ghostwriter will write the article, or perhaps an extended outline containing the message the company wants to transmit, and send

it along to the physician, who may make some changes or simply sign it as written and submit it to a journal, usually scrubbed of any mention of the ghostwriter, the agency, or the pharmaceutical company.²⁸

A meta-researcher named John Ioannidis, who is “one of the world’s foremost experts on the credibility of medical research,” has suggested that “an obsession with winning funding has gone a long way toward weakening the reliability” of such research.²⁹ Ioannidis found that many studies were biased: “Researchers headed into their studies wanting certain results—and, lo and behold, they were getting them. ... [I]t’s easy to manipulate results, even unintentionally or unconsciously. ... Perhaps only a minority of researchers were succumbing to this bias, but their distorted findings were having an outsize effect on published research.”³⁰ Attempting to call attention to the distorted findings of “respected colleagues can have ugly professional repercussions.”³¹ And these problems are not limited to medical research: “Other meta-research experts have confirmed that similar issues distort research in all fields of science.”³²

But that’s not the worst of it. There have been many instances of cynical collaboration by scientists in the nefarious activities of governments and corporations: Think of the scientists who have helped Third World countries (India, Pakistan, North Korea) to develop nuclear weapons, or of the professional global-warming deniers in cahoots with energy companies. And in Silicon Valley, where the dividing-line between scientists and businessmen has been blurred almost to the vanishing-point, some companies, for their own advantage, collaborate with U.S. government spy agencies in snooping on the American public.³³ I don’t know whether any of the scientist-businessmen involved in this collaboration would claim that their motives were “patriotic,” but any such claim, if it were made, would be no more credible than Wernher von Braun’s claim of patriotic motives.

V. In view of all of the foregoing, only an egregious act of self-deception could enable anyone to maintain a belief in the notion that most scientists are motivated primarily by a desire to benefit humanity. A less fatuous version of the scientific ideology represents science not as a humanitarian enterprise, but as morally “neutral”: Scientists simply place certain tools at society’s disposal, and if ill consequences follow, the fault is society’s, for “misusing” the tools; the scientists’ own hands are clean. One

recalls Matthew 27:24—“... he took water, and washed his hands before the multitude, saying, I am innocent...” (Pontius Pilate).

The *Encyclopaedia Britannica* uses this “neutrality” argument in its article on technology;³⁴ Dr. B. alluded to the same argument in his letter of July 24, 2001 (see above, I); Albert Speer mentioned it as an excuse relied on by the technicians who built weapons for Hitler (above, II); and von Braun likewise “emphasized the innate impartiality of scientific research, which in itself has no moral dimensions until its products are put to use by the larger society.”³⁵

Of course, technology *in the abstract* is morally neutral. But von Braun wasn’t building rockets in the abstract realm of Plato’s Forms. He was building rockets for Adolf Hitler, and he knew very well that those rockets would be used to kill people in defense of a regime that was carrying out mass exterminations. However neutral technology may be in the abstract, when you develop new technology or discover a scientific principle that has technological applications, you are performing a concrete action that has a concrete effect on the society in which you live. You are not entitled to disclaim responsibility for that effect on the ground that society *could* have used the technology in some other way—any more than von Braun was entitled to disclaim responsibility for his rockets on the ground that Hitler could have used them solely for space exploration and not as weapons.³⁶ Von Braun was obligated to ask not what Hitler could do with rockets in theory, but what he *would* do with them in practice. Similarly, when you develop new technology today, you are obligated to consider not what society could do with that technology in theory but how the technology is likely to interact with society in practice.

Everything in the foregoing paragraph is obvious, and anyone intelligent enough to be a rocket scientist or a physicist or a molecular biologist should be able to figure it all out in five minutes of honest reflection. The fact that so many scientists resort to the “moral neutrality” argument demonstrates either that they are being dishonest with themselves or with others, or else that they simply haven’t bothered to think seriously about the social and moral implications of their work.³⁷

There *are* a very few scientists who do think seriously about the consequences for society of their work. But their moral scruples do not significantly interfere with their research;³⁸ they do the research anyway, then they salve their consciences by preaching the “ethical” use of their science. In practical terms, their preaching and their scruples are useless.

Alfred Nobel was essentially a pacifist, but that didn't prevent him from developing high explosives. He consoled himself with the hope "that the destructive powers of his inventions would help bring an end to wars."³⁹ We all know how well *that* worked. Einstein preached—ineffectually—about world peace, but he continued his research until virtually the end of his life, despite his opinion of technology and despite the fact that his work had contributed to the development of nuclear weapons. The scientists who participated in the Manhattan Project *first* built the atomic bomb and *afterward* preached about the need for an international agency to control nuclear energy.⁴⁰ Though such an agency was created, it proved ineffectual.⁴¹ In his book *Behavior Control*, Perry London showed that he had thought seriously about the implications of techniques that facilitated the manipulation of human behavior. He offered certain ethical ideas that he hoped would guide the use of such techniques,⁴² but his ethical ideas have had no practical effect whatever. David Gelernter, in his book *Mirror Worlds*, expressed grave concerns about the effect of computer science on society.⁴³ Nevertheless, Gelernter continued to promote technology, including computer science,⁴⁴ and the misgivings he expressed in *Mirror Worlds* have done nothing to mitigate the consequences of computer development.

In 2009 the AAAI (Association for the Advancement of Artificial Intelligence) held a conference that dealt with the dangers posed by the development of artificial intelligence,⁴⁵ and as possible remedies the participating scientists considered "limits on research," the confinement of some research to "a high-security laboratory," and a "cadre" that was to "shape the advances and help society cope with the ramifications" of artificial intelligence. It's hard to tell to what extent all this was a public-relations effort⁴⁶ and to what extent the scientists actually believed in it, but in any case their proposals were hopelessly naïve.

The "limits" considered by the scientists clearly were not intended to stop research in artificial intelligence generally, but only in certain narrow areas that the scientists thought were particularly sensitive. Such "limits" will not be maintained for long. If the scientists of the Manhattan Project had refused to work on weapons research they would have delayed the advent of nuclear weapons only by a few years, because once quantum theory had been developed and nuclear fission discovered, it was inevitable that someone sooner or later would apply that knowledge to make weapons. Similarly, given that research in artificial intelligence is to

continue, it is certain that someone sooner or later (probably sooner) will use the developing technical knowledge to invade any areas that the AAAI may try to declare “off limits.”

The “high-security laboratories” will not be controlled by ordinary citizens, but by powerful organizations such as corporations and governments. Thus the confinement of certain research to high-security laboratories will only increase the already excessive concentration of power in our society.

The “cadre” that is supposed to “shape the advances and help society cope with the ramifications” of artificial intelligence fills me with dread and loathing, because these people’s conception of what is good for human beings scarcely rises to the level of that of a four-year-old child.⁴⁷ I shudder to think what kind of world they would create if they were in control. In practice, however, the “cadre” will have no more success than did the groups of scientists formed after 1945 who tried to ensure that nuclear energy would be “wisely” regulated and used only for peaceful purposes. In the long run, the way artificial intelligence is developed and applied will be determined by the needs of the people who have power and are reaching for more of it.

Thus, whatever ethical standards any scientists may profess, those standards have at most a minimal effect on the overall development of science and technology. What I wrote in paragraph 92 of ISAIF was essentially correct: “Science marches on blindly, without regard to the real welfare of the human race or to any other standard, obedient only to the psychological needs of the scientists and of the government officials and corporation executives who provide the funds for research.”

NOTES

1. By the time I got around to writing my reply, Dr. P.B. was no longer at the address from which he had written me in 2001. Since his name was an extremely common one, it proved impossible to locate him definitely. Eventually a correspondent sent me an address that he *claimed* was that of the right Dr. P.B., and I sent my reply to that address but received no answer. It was probably the wrong address.

2. Speer, p. 212.

3. NEB (2003), Vol. 29, “War, Technology of,” pp. 569–570: 4,000 V-2s were launched against Allied cities, they killed on average about 5 persons per launch, $5 \times 4,000 = 20,000$. See also *The Week*, March 6, 2009, p. 39.

4. NEB (2003), Vol. 2, “Braun, Wernher von,” p. 485.

5. R.J. Evans, p. 560. Apart from the extermination of the Jews, plenty of other Nazi atrocities were widely known in Germany at the time. See, e.g., Rothfels, *passim*.

6. NEB (2003), Vol. 19, "Exploration," p. 47.

7. The complete text of the speech can be found in Smith & Weiner, pp. 315–325.

8. Oppenheimer's view on this point has been explicitly confirmed by many other physicists. Kolbert, "Crash Course," p. 76. See also Burnet, p. 81: "In today's laboratory, what is desired is usually the answer that will fill a gap in the accepted structure of knowledge. It is immaterial whether filling the gap will either directly or indirectly provide health, comfort or wealth to other members of the community."

9. Smith & Weiner, pp. 315, 350n20.

10. *Ibid*.

11. Burnet's Chapter Five doesn't directly and explicitly address the question of scientists' motivations, but the author does in effect say a great deal about his own motivations and those of other scientists. He makes clear that scientists are not motivated primarily (or at all?) by a desire to benefit the human race, and he refers repeatedly to status ("recognition," pp. 82, 91; "prestige," p. 87; dominance-ranking, *passim*) as a major reward for scientists. When Burnet's book was published in 1970, the concepts of "power process" and "surrogate activity" had not yet been invented, but Burnet in effect makes clear the significance of science as a surrogate activity through which people having the relevant talents can experience the power process. Thus, on pp. 90ff he discusses the importance of providing suitable work for talented people; e.g.: "One of the great social necessities of an affluent society is to ensure that as large a proportion of the highly intelligent people who are born into the community find occupation that makes use of their intelligence and *feels* worth doing" (p. 91); "the day-to-day elucidation of [meteorological phenomena] can provide high level occupation for a steadily increasing number of scientists..." (p. 93); "an irrational technological and scientific momentum is generated on the basis that because a difficult or spectacular thing can be done, it must be done. It is the equivalent at the scientific and technological level of the famous answer as to why one should climb Everest—because it is there." (p. 98).

12. See Zimmermann, pp. 439–442; NEB (2003), Vol. 10, "Siemens, Werner von," p. 787.

13. Klemm, p. 353.

14. Zinsser, pp. 12–14.

15. Albert Einstein, Letter to Heinrich Zangger, Dec. 6, 1917, in Schulmann et al., Vol. 8, Part A, pp. 561–62. The translation given here is that of Craig, p. 14. Further on in the same letter, Einstein refers to the technological

Verseuchung (corruption, contamination, or pollution) of human life, which suggests that his comparison of modern technology to an axe in the hand of a criminal was not just an offhand remark but the expression of a definite opinion.

16. NEB (2003), Vol. 18, "Einstein," p. 157.

17. *Ibid.*

18. Schilpp, pp. 1–94. The autobiography is printed in the original German with an English translation on alternate pages.

19. For this entire paragraph, see *ibid.*, pp. 2, 4. See also Warburg et al., pp. 29–32. Here, in a romantic flight of fancy, Einstein addresses the motives for scientific research. Let it suffice to say, this rhapsody makes clear that Einstein's own motives were unconnected with any desire to benefit the human race.

20. Monnerot, pp. 136, 140.

21. Urban-Klaehn, p. 10.

22. Wiener, pp. 271–72.

23. Compare Kaczynski, *Anti-Tech Revolution*, Chapt. Three, Part II, discussion of Postulate 4.

24. As will be seen from *ibid.*, the "corruption" of a movement doesn't necessarily refer to dishonesty, though dishonesty certainly is included under the heading of corruption. When we say that a movement is "corrupt" we mean merely that most members of the movement are motivated by conventional personal goals such as money, status, or a career rather than by commitment to the putative ideals of the movement. Probably the majority of scientists today are not consciously dishonest, but that doesn't mean that their motives for doing scientific work are idealistic.

25. Freedman, p. 82. See also Kelly & Wearne, p. 13, and especially Lam, p. 19.

26. *Time*, July 17, 2006, p. 11.

27. *The Economist*, Sept. 10, 2011, pp. 91–92.

28. Elliot, p. 26. See also Lam, p. 19.

29. Freedman, p. 78.

30. *Ibid.*, p. 80.

31. *Ibid.*

32. *Ibid.*, p. 85.

33. Risen & Wingfield, pp. A1, A17.

34. NEB (2003), Vol. 28, "Technology, The History of," p. 471.

35. *Ibid.*, Vol. 2, "Braun, Wernher von," p. 485.

36. Rothfels, p. 43, writes: "It can be argued that the believers in technology and the highly specialized experts [who worked for the Nazi regime] took upon themselves an exceptional responsibility through their so to speak 'abstract' dedication to maximum performance, a dedication that pretended to have no connection with the purpose that was being served." But this doesn't need to be argued—it's obvious!

37. For a relevant personal experience of the author, see Appendix Eight.

38. Some scientists do impose a token limitation on their research, as by refusing to participate in weapons development. This does not demonstrate serious thought on the part of the scientists, for weapons represent only the most crudely obvious of the negative applications of science; civilian applications are in the long run far more important in determining the future of our society. Moreover, a scientist's refusal to work directly on weapons may do little to mitigate the effect on weapons development of his research. For example, even if a researcher in aerodynamics works only in connection with the design of civilian aircraft, there is nothing to prevent the information he provides from subsequently being applied to military aircraft as well.

39. NEB (2003), Vol. 8, "Nobel, Alfred Bernhard," p. 738.

40. Smith & Weiner, pp. 303, 310.

41. Kaczynski, *Anti-Tech Revolution*, Chapt. One, Part I, discussion of "Atoms for Peace."

42. London, as referenced in our List of Works Cited.

43. Gelernter, *Mirror Worlds*, pp. 213–225.

44. Gelernter, "Technology Crisis."

45. Markoff, "Scientists Worry Machines May Outsmart Man."

46. I've been told that in recent years some scientists' organizations or their public-relations firms have been developing quite sophisticated arguments that are intended to justify the role of science in society. A study of the science establishment's propaganda, especially of sophisticated propaganda directed at intelligent audiences, would be highly desirable and important, but would be beyond my own capacity under existing circumstances. In any case, however sophisticated the propagandists' arguments may be, everything relevant that I've seen in the media up to the present (2016) seems to indicate that most scientists' thinking about the social and moral implications of their work is still at a superficial, or even a juvenile level. Of course, there are exceptions, as we've noted.

47. Example: Apple co-founder Steve Wozniak thinks that "robots taking over would be good for the human race," because they'll be "smarter than us" and will make us like "the family pet and taken care of all the time." See S. Gibbs, as referenced in our List of Works Cited.